

## ***Gerry E. Studds* Stellwagen Bank National Marine Sanctuary Ecosystem-Based Management Action Plan**

### **Overview**

The U.S. Commission on Ocean Policy offers the following definition of ecosystem-based management (EBM):

“Ecosystem-based management looks at all the links among living and non-living resources, rather than considering single issues in isolation. This system of management considers human activities, their benefits, and their potential impacts within the context of the broader biological and physical environment. Instead of developing a management plan for one issue (such as a commercial fishery or an individual source of pollution), ecosystem-based management focuses on the multiple activities occurring within specific areas that are defined by ecosystem, rather than political, boundaries.”

The approach put forth by the Commission is entirely consistent with the policies and purposes of the National Marine Sanctuaries Act (NMSA). The NMSA provides authority to the National Marine Sanctuaries “for comprehensive and coordinated conservation and management of these marine areas, and activities affecting them, in a manner which complements existing regulatory authorities...” The NMSA directs the sanctuary to “maintain the natural biological communities in the national marine sanctuaries, and to protect, and, where appropriate, restore and enhance natural habitats, populations, and ecological processes;...”, as well as, “create models of, and incentives for, ways to conserve and manage these areas, including the application of innovative management techniques;...”, while at the same time “facilitating uses to the extent compatible with the primary purpose of resource protection...”

This Action Plan strives to adopt this approach by detailing a series of actions that will lay the foundation for effective ecosystem-based management.

### **Description of the Issues**

The public comment scoping process conducted by the Stellwagen Bank National Marine Sanctuary (SBNMS) in 1998, and again in 2002, identified several concerns relative to the need for comprehensive ecosystem protection and conservation of biological diversity at the SBNMS. Issues raised during public scoping were summarized as follows:

- Need for comprehensive ecosystem protection
- Zoning in the SBNMS including no-take zones
- EBM practices
- Boundary Modification

This Action Plan addresses these public issues comprehensively.

## Issue Statement

EBM arose in the late 20<sup>th</sup> century to address the pervasive scientific uncertainty inherent in natural systems and the failures of single species management approaches to adequately address that uncertainty. The concept of an ecosystem, on which any discussion of EBM depends, can be defined as a biological community together with its associated physical environment. In the context of the marine environment, this would include all marine organisms including humans as well as the physical properties of the water column and the seafloor.

As the sanctuary is not an ecosystem unto itself but rather part of the much larger Gulf of Maine (GOM) ecosystem, the application of EBM to the SBNMS can be approached along two parallel tracks. First, the application of EBM at the SBNMS will involve the intensive collaboration with other regional agencies charged with managing components of the ecosystem beyond the sanctuary boundaries. Second, for management within the sanctuary boundaries, the guiding principles of EBM can be used in an EBM approach where an obvious sub-set of the larger GOM ecosystem is being managed.

There are no comprehensive EBM plans in the southern GOM at this time. The SBNMS currently regulates the mining of sand and gravel, disturbance of the seafloor (with the exception of fishing activity), and dumping of waste material within its boundaries. Fisheries management in the Federal waters of the region is conducted on a species by species basis. Similarly, even though the National Oceanic Atmospheric Administration (NOAA) Fisheries Atlantic Large Whale Take Reduction Team has grouped a number of large cetaceans under its auspices, the Marine Mammal Protection Act is enforced on a species by species basis.

## Working Group

In order to address these issues the Sanctuary Advisory Council (SAC) convened an EBM Working Group (WG) composed of 19 members representing a cross-section of stakeholders. The EBMWG met seven times over a 9 month period and developed three alternative scenarios (A-C) representing a range of protection for the group's consideration. The EBM WG decided to focus on crafting a compromise action plan (around scenario B) which ultimately the group came to consensus on. This Action Plan is the consensus document. Scenarios A and C are included as appendices to this document for reference.

## Goal Statement

The EBM WG considered the many definitions of EBM within the context of the sanctuary's situation and came to consensus on the following definition and goal:

*Ecosystem-Based Sanctuary Management (EBSM) integrates knowledge of ecological interrelationships to manage impacts within sanctuary boundaries. The general goal of EBSM is to protect the ecological integrity of the SBNMS while recognizing that the sanctuary is nested within GOM large marine ecosystem. Effective implementation of EBSM should: (1) consider ecological processes that operate both inside and outside sanctuary boundaries, (2)*

*recognize the importance of species and habitat diversity, and (3) accommodate human uses and associated benefits within the context of conservation requirements.*

## **Objectives**

The objectives of this plan are to:

- Comply with the purposes and policies of the NMSA
- Understand ecosystem structure and function
- Recognize the interconnectedness with the larger ecosystem
- Recognize our uncertainty of how ecological systems function
- Manage adaptively
- Maintain public accessibility to SBNMS
- Achieve environmental sustainability of sanctuary resources
- Maintain and enhance biological diversity and ecological integrity
- Reduce habitat impacts by users
- Establish a process for creating a zoning scheme

## **Addressing the Issues – Strategies for this Action Plan**

The EBM WG developed the following research and management strategies to begin implementing EBM and establishing the infrastructure and framework for its continued development. Measures to evaluate the performance of strategies and their associated activities are listed at the end of each strategy/activity group.

There are six Strategies in the EBM Action Plan:

- EBM.1 – Establish a Research Steering Committee
- EBM.2 – Establish a Collaborative Research Consortium
- EBM.3 – Establish an Information Management Program
- EBM.4 – Understand Ecosystem Structure and Function
- EBM.5 – Protect Ecological Integrity
- EBM.6 – Evaluate the Need and Feasibility for Modifying the Sanctuary Boundary

Each strategy is detailed below.

### **STRATEGY EBM.1 – ESTABLISH A RESEARCH STEERING COMMITTEE**

#### ***Strategy Summary***

The committee should be a WG of the SAC that will assist in developing a research and monitoring plan for the SBNMS, recommending parameters for monitoring that are easily measurable and can serve as biological reference points, and developing an operational and quantifiable definition of ecological integrity.

Strategy Performance Measure: Research steering committee is established by SAC within 1 year.

### ***Activities (1)***

#### ***(1.1) Establish a steering committee.***

The SAC must establish the steering committee as a WG so that outside members can participate.

Status: Completed by year 1.

Potential Members: SBNMS staff, New England Fishery Management Council (NEFMC) staff, NOAA Fisheries Northeast Fisheries Science Center (NEFSC) staff, academia, fishing industry, conservation organizations.

## **STRATEGY EBM.2 – ESTABLISH A COLLABORATIVE RESEARCH CONSORTIUM**

### ***Strategy Summary***

The consortium shall be composed of academic, government, fishermen, and private interests who seek to understand how the sanctuary functions. The consortium is a more informal body than the steering committee and its purpose is to further the knowledge of the sanctuary system by fostering collaborative research between users and researchers on topics such as marine mammal acoustics, prey dynamics, oceanography, water quality changes, fish movement, etc.

### ***Activities (2)***

#### ***(2.1) Convene sanctuary science symposium.***

The science coordinator shall organize a symposium on sanctuary science for the purpose of laying the foundation for a consortium and identifying the high priority issues that need to be investigated. This may become a biannual symposium the objective of which is to share knowledge with the SAC, SBNMS staff and other interested parties.

Status: Completed by year 1.

Potential Partners: Researchers, managers, academia, public.

#### ***(2.2) Initiate consortium.***

The science coordinator shall initiate the consortium through email/listserve and a website specifically designed to foster the sharing of ideas and posting of results.

Status: Completed by year 2.

Potential Partners: Researchers, managers, academia, public.

## STRATEGY EBM.3 – ESTABLISH AN INFORMATION MANAGEMENT PROGRAM

### *Strategy Summary*

Using SBNMS' existing infrastructure capacity with outside software expertise, the sanctuary will develop a system with which to integrate, process, synthesize, and analyze scientific data. To maximize the utility of such a system, the user should be able to connect across the system for individual querying of all available data sets. The system will be made available for practical application on both an intuitive and expert level.

The objective of this system is to develop a well-designed information management and dissemination tool to facilitate science-based management. The system is designed to be widely applicable and accessible to SBNMS staff, scientists, decision makers, and the public. By setting up a database on an in-house server, SBNMS can expand the range and uses of existing data. Additionally, any user will be able to bring in a database, upload it into the sanctuary's system, and carry out any type of data analysis or processing from statistical analysis to support for management decisions.

Strategy Performance Measure: Information management system with public access shall be operational within 3 years.

### *Activities (7)*

#### **(3.1)** *Establish quality assurance/quality control program.*

This program will ensure the integrity and quality of the data from the moment it is collected to the point at which it is archived.

Status: Completed by year 1.

Potential Partners: Internal.

#### **(3.2)** *Establish proprietary use policy.*

This policy will accord researchers sole rights to the data for a set time period after data collection to give them the first opportunity to publish. The policy should be modeled after the one used for the Global Ocean Ecosystems Dynamics (GLOBEC) program.

Status: Completed by year 1.

Potential Partners: Researchers.

#### **(3.3)** *Establish a full-time data manager.*

A full-time data manager is needed to administer this program.

Status: Completed by year 1.

Potential Partners: Internal.

**(3.4) Design an information management system.**

An information management system shall be designed that meets specified requirements related to data input, data access by various users, metadata, analysis, etc.

Status: Completed by year 1.

Potential Partners: Contractors, researchers, educators.

**(3.5) Implement an information management system.**

The information management system will be implemented first for internal use by SBNMS staff and then for access by the public.

Status: Completed by year 1.

Potential Partners: Contractors.

**(3.6) Process existing data.**

Databases maintained by the SBNMS or that SBNMS has access to will be processed and made available for analysis.

Status: Completed by year 2.

Potential Partners: Research steering committee.

**(3.7) Design and implement a web portal for public access to databases.**

The sanctuary has an obligation to make the data it collects or pays for accessible to the public within a reasonable timeframe. A web portal shall be designed that enables this access while maintaining the security of the NOAA network.

Status: Completed by year 3.

Potential Partners: Researchers, managers, academia, educators, public.

## **STRATEGY EBM.4 – UNDERSTAND ECOSYSTEM STRUCTURE AND FUNCTION**

### ***Strategy Summary***

Ecosystem structure refers to how the components of an ecosystem are arranged, both horizontally and vertically. Ecosystem function refers to the processes that structure the ecosystem such as predation, succession, reproduction, and competition. The purpose of this strategy is to understand what components make up the sanctuary ecosystem and what processes influence the arrangement of the components.

Strategy Performance Measures:

1. Draft operational definition of ecological integrity by year 1.
2. Appropriate measures of biodiversity selected by year 1.
3. Trend analysis of suite of indicator species shall be analyzed by year 3 and completed thereafter on an annual basis.
4. Nutrient loadings in the sanctuary from local and far-field sources shall be quantified by year 5.
5. The dispersal rate and trajectories of model larvae under various environmental conditions shall be quantified by year 3.
6. The movement rates and distances of cod and redfish over gravel and boulder habitats during all seasons shall be quantified by year 4.
7. Real-time oceanographic and meteorological data shall be provided via the web for at least two locations within the SBNMS by year 5.
8. Benthic habitats in the entire sanctuary shall be mapped at a scale of 1:60,000 or better by year 5.

**Activities (14)**

**(4.1) *Develop an operational definition of ecological integrity.***

Ecological integrity is a term that is location and scale dependent. It is both an intuitive and a technical term. While ecological integrity has not yet been defined for the SBNMS various definitions point to the notion of maintaining the wholeness of an ecosystem, or portion thereof, such that the system's native diversity and functioning are likely to persist. The objective of this activity is to develop an operational definition of ecological integrity that can be evaluated and monitored over time.

Status: Draft operational definition and metrics for measuring ecological integrity by year 1.

Potential Partners: Proposed research steering committee, proposed consortium, fishermen, other users.

**(4.2) *Develop appropriate measures of diversity and those processes that mediate patterns of diversity.***

There are various ways to measure biological diversity and the processes that contribute to it. This activity is aimed at evaluating various measures and determining which ones most appropriately reveal the effectiveness of management actions.

Status: Completed by year 1.

Potential Partners: Proposed research steering committee, proposed consortium, academia.

**(4.3) *Establish a biological and physical monitoring program.***

This program shall discern changes in the natural systems of the sanctuary. This program shall develop a comprehensive understanding of changes in ecosystem status. One objective of this

monitoring program shall be to determine the efficacy of any zones that are implemented in the sanctuary.

Status: Initiated by year 2.

Potential Partners: Proposed research steering committee, proposed consortium, Massachusetts Fishermen's Partnership (MFP) Fishermen's Initiative for Scientific Habitat and Ecosystem Research (FISHER), other users.

**(4.4) *Establish an improved human use monitoring program.***

This requirement is necessary in order to fully understand the level of usage in the sanctuary, the socioeconomic impacts of regulations, the spatial and temporal distribution of usage, and the usage adjacent to currently closed areas. The program should provide adequate spatial resolution to confidently reconstruct the spatial distribution of human impacts with statistical confidence relative to habitat. Such activities could include automated information systems (AIS), vessel monitoring systems (VMS), radar, and refinement of vessel trip reports (VTR) and call in system. These activities will be implemented in consultation with the NEFMC, NOAA Fisheries, U.S. Coast Guard (USCG), citizens and other concerned parties.

Status: Initiated by year 1.

Potential Partners: NEFMC, NOAA Fisheries, USCG, citizens, other concerned parties.

**(4.5) *Establish a directed research program.***

This program shall complement the monitoring program by investigating ecological processes that explain the patterns identified from monitoring. The research steering committee should advise on the questions to be answered.

Status: Initiated by year 2.

Potential Partners: Research steering committee, consortium, fishermen, other users.

**(4.6) *Establish collaborative research programs with the recreational and commercial fishing industries to help answer specific questions about the ecology of the sanctuary and its use.*** Examples would include the Northeast Consortium (NEC) and the MFP FISHER within the SBNMS.

Status: Initiated by year 2.

Potential Partners: MFP, NEC, regional nongovernmental organizations (NGO's), NEFMC, NOAA Cooperative Research Partners Initiative (CRPI), universities.

**(4.7) *Develop a dynamic ecosystem model linking patterns of diversity with ecological processes.*** An initial product of this effort will be a static conceptual model showing functional relationships between species. The research steering committee will then review the model and make recommendations to SBNMS.



Status: Initiated by year 2.

Potential Partners: Proposed research steering committee, academia, contractors.

**(4.8) *Classify and map benthic habitats.***

The SBNMS currently has high resolution multibeam imagery of the entire SBNMS. However, benthic habitats have not been classified or mapped based on the multibeam data and groundtruthing data (e.g., video, sediment sampling and other means). These data would greatly facilitate planning and resource management efforts.

Status: Completed by year 4.

Potential Partners: U.S. Geological Survey (USGS), proposed consortium, academia, MFP.

**(4.9) *Understand movements of organisms over landscape features.***

Understand movements of organisms relative to sanctuary seascapes and movement between the sanctuary and surrounding waters. Complete ongoing research, including cooperative research, to tag and track Atlantic cod and expand the research to include other species.

Status: Ongoing.

Potential Partners: Proposed consortium, contractors, academia, MFP, fishermen.

**(4.10) *Understand the effects of natural disturbance (e.g., storm and tidal events, predation) on seafloor habitats.***

Status: Ongoing.

Potential Partners: Proposed consortium, contractors, academia, MFP, fishermen.

**(4.11) *Develop predictive larval recruitment, dispersal, and connectivity models.***

Models shall include sources, sinks, larval concentrations, and larval behaviors using data from various sources.

Status: Initiated by year 2.

Potential Partners: Academia, state and federal agencies.

**(4.12) *Develop an internal oceanographic circulation model.***

This model will interface with other models and will tie together local, regional, and larger-scale patterns. Development of this model is essential to understand and predict egg and larval transport, and the fate and effect of nutrients and pollutants.

Status: Completed by year 3.

Potential Partners: Academia, GOM Ocean Observing System (GOMOOS).

**(4.13) Quantify pollutant loadings.**

The importance of natural and anthropogenic nutrient and other pollutant loadings to sanctuary waters, including flora and fauna, from local, sub-regional (Mass Bay), regional (GOM), and global sources shall be quantified.

Status: Completed by year 5.

Potential Partners: Academia, Massachusetts Water Resources Authority (MWRA), USGS.

**(4.14) Establish an integrated ocean observing system.**

This system shall collect real-time data at multiple depths on oceanographic and biological parameters identified to aid in ecosystem based management. The system could be a subset of the GOMOOS and would be implemented with a combination of surface buoys and seafloor sensors.

Status: Completed by year 5.

Potential Partners: GOMOOS, academia, fishermen, shippers.

## **STRATEGY EBM.5 – PROTECT ECOLOGICAL INTEGRITY**

### ***Strategy Summary***

The primary goal of EBM is to protect the ecological integrity of the sanctuary. No one action is sufficient to protect the integrity of the system short of making the sanctuary a wilderness area. The purpose of this strategy is to implement a set of complementary actions that will ensure the integrity of the ecosystem.

### ***Strategy Performance Measures:***

1. Provide recommendations to the SAC on a zoning scheme by year 2.
2. Request that the NEFMC and NOAA Fisheries take action to prohibit the taking of sand eels in the SBNMS by year 1.
3. The level of bycatch in the SBNMS will be assessed by year 3.
4. The trophic importance of forage species will be assessed by year 4.

### ***Activities (4)***

**(5.1)** *Establish a zoning WG to evaluate the adequacy of existing zoning schemes in SBNMS to satisfy the scientific requirements and meet the goals of EBSM and if needed, develop a modified zoning scheme (including a consideration of fully protected reserves) to meet those goals and requirements.*

The zoning WG shall be established by the SAC at its November 2004 meeting for the purpose of reviewing and evaluating data and information as it becomes available through various venues

(e.g., Omnibus Essential Fish Habitat process, sanctuary efforts) and making a recommendation to the SAC and ultimately to the sanctuary superintendent. The membership of the zoning WG shall be of representative stakeholder groups similar to the EBM WG. The zoning WG shall begin meeting in January 2005 in order to efficiently utilize the time that the final management plan is in preparation.

The zoning WG shall develop metrics for zone performance based on the objectives of the various zones as determined by the WG. These metrics shall form the foundation of a monitoring program designed to determine the efficacy of the zoning scheme and recommend any needed changes to accomplish the goals of the zoning scheme and EBSM.

The zoning WG shall make recommendations to the SBNMS regarding the zoning scheme within two years of the implementation of the final management plan as defined by the publication date for the Federal Register Notice notifying the public of the availability of the final management plan.

Status: Completed by year 2.

Potential Partners: Representative stakeholders.

**(5.2) *Recommend implementation of a permanent ban on the exploitation of sand eels (*Ammodytes spp.*) within the SBNMS.***

Sand eels are an important forage species for baleen whales, groundfish, and pelagic fish and are an important component of the food web of the SBNMS and are currently unexploited. This activity will be implemented by the NEFMC and NOAA Fisheries at the request of the SBNMS.

Status: Initiate request by year 1.

Potential Partners: NEFMC, NOAA Fisheries, Atlantic States Fisheries Management Council (ASFMC).

**(5.3) *Assess and minimize bycatch and discard.***

Bycatch of target and non-target species shall be minimized in the SBNMS. This activity will be implemented by the NEFMC.

Status: Completed by year 3.

Potential Partners: NEFMC, NOAA Fisheries, ASFMC.

**(5.4) *Evaluate the need and ability to protect an adequate forage base for species within the sanctuary.***

Forage species such as Atlantic and river herring, squid, sand lance, and mackerel are an essential trophic resource for larger fishes, marine mammals and birds.

Status: Completed by year 4.

Potential Partners: NEFMC, NOAA Fisheries, MFP FISHER.

## **STRATEGY EBM.6 – EVALUATE THE NEED AND FEASIBILITY FOR MODIFYING THE SANCTUARY BOUNDARY.**

### ***Strategy Summary***

This strategy is intended to evaluate the need for and feasibility of modifying the SBNMS boundary to include more of Jeffrey's Ledge. Jeffrey's Ledge may be an important habitat and resource area for characteristic species of the sanctuary. If results indicate that a change in the boundary is warranted, action should be taken by the SAC and the SBNMS to modify the sanctuary boundaries to include more of Jeffrey's Ledge.

### ***Strategy Performance Measures:***

1. Characterize the ecology and socioeconomics of Jeffrey's Ledge by year 5.
2. Understand the ecological relationship of Jeffrey's Ledge with the SBNMS by year 5.

Status: Completed by year 5.

Potential Partners: NEFMC, NOAA Fisheries, USCG, Whale Center of New England (WCNE), Center for Coastal Studies (CCS), stakeholders.

## **CONSIDERATIONS**

The EBM WG acknowledges that the following activities are important components of EBM and should be considered in an EBM plan.

- Assess the extent of invasive species.
- Eliminate ballast water exchange.
- Enforce existing watershed protection measures.
- Assess speed restrictions.
- Mitigate impacts from pipelines, cables, and conduits.

However, the EBM WG recognizes that other WGs with more appropriate expertise have dealt with these issues in detail. Therefore, the EBM WG merely forwards them to the SAC for incorporation into a comprehensive EBM plan.

**APPENDICES**  
**(ECOSYSTEM-BASED MANAGEMENT)**

## **APPENDIX EMB.I – SBNMS Ecosystem-Based Management Plan A Action Plan**

### **Overview**

This group chose to describe two alternatives. The first is the idea of Absolute Wilderness, which defines core wilderness values with which the second alternative, Urban Wilderness, can be compared. The group recognizes that Urban Wilderness is the more likely outcome.

### **Description of the Issues**

#### **Issue Statement**

#### **Goal**

#### **Objectives**

### **Addressing the Issues – Strategies For This Action Plan**

## **STRATEGY EBM.1 – ABSOLUTE WILDERNESS SCENARIO**

### ***Strategy Summary***

In order to manage the SBNMS in a true wilderness state, all disruptive activities must cease. The SBNMS would become a totally protected, non-extractive reserve. In addition, the borders of the sanctuary would have to be extended so as to encompass Jeffreys Ledge and adjacent areas of high topographic relief, such as “the Fingers.” This would yield two important benefits. First, areas rich in both herring (to the north) and sand lance (mostly Stellwagen Bank) would be protected, thus providing insurance against low-abundance years for any one of these primary forage species. Second, a crucial feeding area for the north Atlantic right whale would be protected. In addition, the core protected area encompassing the two banks should be surrounded by an easement of additional grounds in which activities that severely disrupt habitat and the distribution and abundance of wildlife are curtailed.

#### **Benefits:**

- Whalewatching, wildlife watching, tourism (including self contained underwater breathing apparatus [SCUBA])
- Existence value
- Transit value
- Reduced uncertainty through provision of reference habitats for scientific research necessary for resource management in rest of GOM
- Spillover and stock enhancement value of protected brood stock and individuals

#### **Cost:**

- No fishing

- Zero ballast water exchange
- Requires the elimination or destruction of all artifacts, such as shipwrecks and archaeological sites

Strategy Performance Measure:

## **STRATEGY EBM.2 – URBAN WILDERNESS SCENARIO**

### ***Strategy Summary***

It is virtually impossible to manage the SBNMS as a true wilderness, because many of the organisms that move through the sanctuary are severely impacted outside of its borders. In addition, SBNMS waters are under burgeoning pressure as the regional human population increases in numbers and wealth, thus elevating the demand for use of coastal waters for commercial and recreational fishing, boating, and wildlife watching. In other words, humans are part of the ecosystem. In recognition of these considerations, an alternative paradigm is put forward of an “urban wilderness”, in which the goal is the defense and restoration of such wilderness values as can be achieved in the context of proximity to the heavily settled watersheds and heavily impacted waters of the GOM. The urban wilderness scenario employs zoning and impact restrictions to preserve a substantial portion of the ecological services that wilderness would provide.

The primary mechanism for achieving and maintaining wilderness values is the close monitoring of the ecosystem to allow for more informed and confident decisions in response to changes in human impacts and system state. The core of the program is a well-designed network of research areas and monitoring activities. These provide the data-stream required to manage human activities within the sanctuary in an adaptive manner, and to thus maintain the viability of human activity in a self-supporting system. The difference between the “urban wilderness” and “compromise” scenarios is the explicit goal of promoting wilderness attributes within the sanctuary; however, the “compromise” scenario should incorporate “urban wilderness” objectives while allowing extractive use through careful zoning. The urban wilderness scenario differs from “sustainable use” in system attributes such as the size-frequency distribution of organisms, the ecological resiliency of the sanctuary, and the emphasis on maximizing standing biomass and species diversity rather than gross rates of biomass production.

The return of natural ecological processes to a sanctuary that is nonetheless subject to some level of extraction and modification, can be effected by safeguarding certain key attributes of the system. In other words, these are non-negotiable requirements of an urban wilderness approach.

### Benefits:

- Whalewatching, wildlife watching, tourism (including SCUBA).
- Existence value.
- Transit value.
- Reduced uncertainty through provision of reference habitats for scientific research necessary for resource management in rest of GOM.

- Spillover and stock enhancement value of protected brood stock and individuals.
- Limited fishing.
- Encourage the growth of small-scale, low-impact fisheries consistent with growth of population in the urban centers and demand for recreation.

Costs:

- Encourage the growth of small-scale, low-impact fisheries consistent with growth of population in the urban centers and demand for recreation. This is a cost relative to an Absolute Wilderness model, but a benefit from the Urban Wilderness perspective of the public commons, artisanal industries, including fisheries, etc.
- Loss of some existence value.
- Loss of much of the reference value of absolute wilderness (the establishment of a baseline against which the effects of human activities can be measured). This can be addressed by reserving a portion of the SBNMS as a core region of absolute wilderness.

The report of the U.S. Commission on Ocean Policy “highlights the fact that fishing is a privilege, not a right”. It reflects the notion that “the dedicated privilege being granted is access to the fish, rather than the fish themselves.” In the “urban wilderness” scenario, this privilege is granted, but in balance to other privileges that people seek from sanctuary waters, including the privilege of viewing a wild ocean and the wildlife that it would contain but for its removal by people with contrary values.

Strategy Performance Measure:

**Activities (13)**

**(2.1)** *Close fisheries on pelagic forage species: Atlantic and river herrings, and the two species of sand lance.*

**(2.2)** *Change boundaries to encompass local ecosystem dynamics. Specifically, expand the sanctuary borders to the north to include extensive areas of bottom that support the herring (to the north) and the sand lances (to the south).*

**(2.3)** *Zone refugia for large brood fish as off-limits to all extraction (could allow catch-and-release fishing however).*

**(2.4)** *Conduct research to determine necessary areal zones to protect, and to monitor the efficacy of these closures.*

**(2.5)** *Fishing would be allowed but on the basis of ecosystem parameters, not just the usual demographic criteria (i.e., not maximum sustainable yield [MSY]).*

**(2.6)** *Fishing must be restricted to low-impact technologies, within delimited zones, the goal being sustainability within the sanctuary.*



Encourage public sector access to facilitate a general shift from industrial to artisanal/small scale/recreational fisheries. This allows the greatest benefit for the greatest number of people, and is sustainable over time.

*(2.7) Restructure shipping lanes to reduce wildlife and endangered species impacts; pursue through direct benefits to Homeland Security.*

*(2.8) Speed limit on vessels through the sanctuary, below 13 knots (the mortality threshold for ship-whale collisions).*

*(2.9) Fully enforce the Clean Air Act and Clean Water Act (CWA) to reduce watershed inputs to the sanctuary.*

Watershed management to minimize turbidity and diminish coastal runoff, including, but not limited to , nutrient plumes from rivers. Such management strategies may include, for example, requiring forested easements along all watersheds.

*(2.10) Zero ballast water exchange in the sanctuary to reduce invasive species.*

*(2.11) Every effort must be made to minimize harmful interactions with all marine mammals including North Atlantic right whales, and to minimize degradation of the trophic system that supports them (i.e., copepods and forage fish).*

*(2.12) Some areas must be well selected for full protection to protect biodiversity, and provide untouched reference areas for adaptive management.*

*(2.13) Any use or crossing of the sanctuary for cables, pipelines, or conduits must be subject to review and assessed for costs to cover continuing impact monitoring for the lifetime of the easement.*

## APPENDIX EMB.II – SBNMS Ecosystem-Based Management Plan C Action Plan

### Overview

The sustainable use Action Plan is designed to protect sanctuary resources through existing best management practices. This plan focuses on sustainable use with an emphasis on maintaining the national benefits that are produced in the waters of SBNMS.

Stellwagen Bank is part of the GOM ecosystem. Oceanographic conditions in the GOM region are influenced by inputs of cold, low-salinity Scotian Shelf water and warm high-salinity slope water (Figure 1). The relative strength of these two primary inputs is dynamic and is influenced by low-frequency changes in the North Atlantic Oscillation (NAO) (Figure 2). Changing environmental conditions alter abiotic and biotic processes and make it challenging to discern between human and environmental impacts on the ecological integrity of sanctuary resources. Complex interrelationships among abiotic and biotic processes along with changing environmental conditions also make it difficult to precisely define what the term “ecological integrity” means (Figure 3). For this reason, a primary focus of the sustainable use plan is to improve monitoring of both biological and environmental parameters within the sanctuary.

Figure 1. Shallow (<75 m) and deep (>150 m) currents in the GOM (Figure courtesy of Dr. David Mountain, NEFSC).

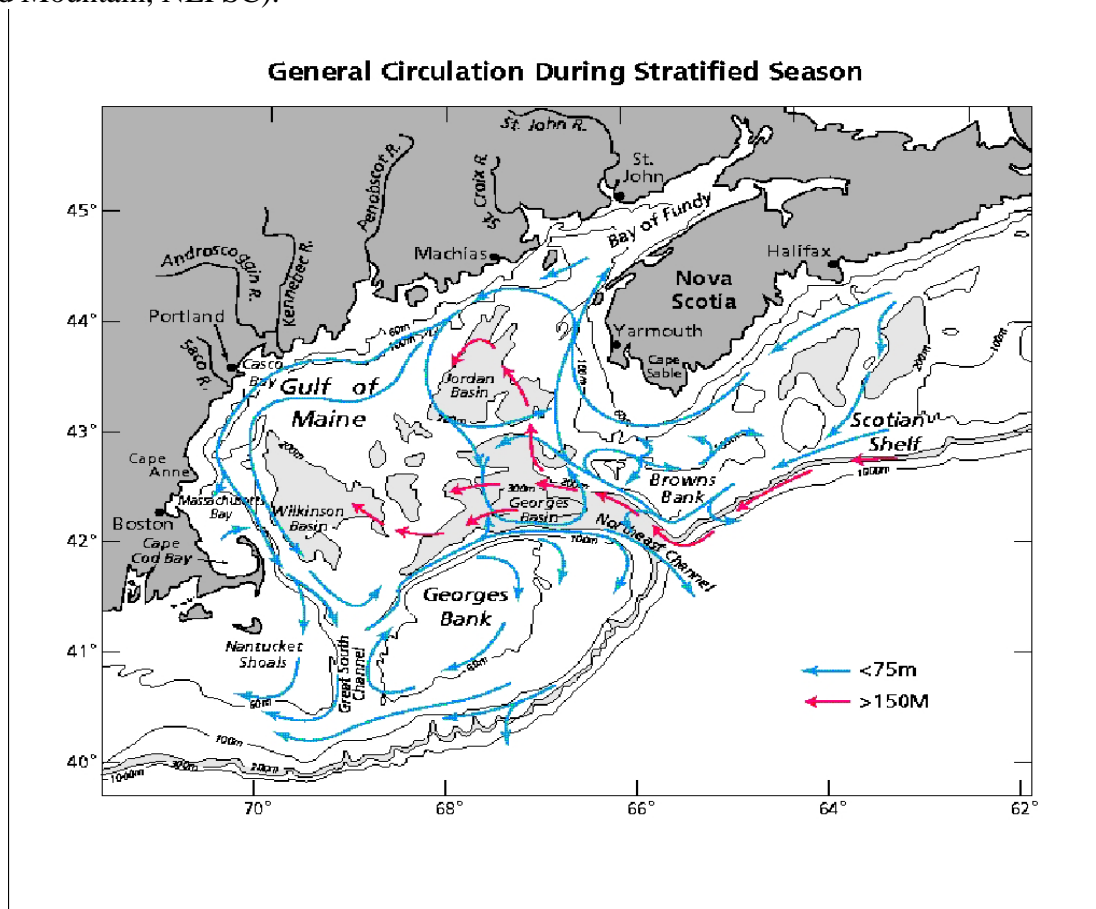


Figure 2. Low-frequency changes in the NAO.

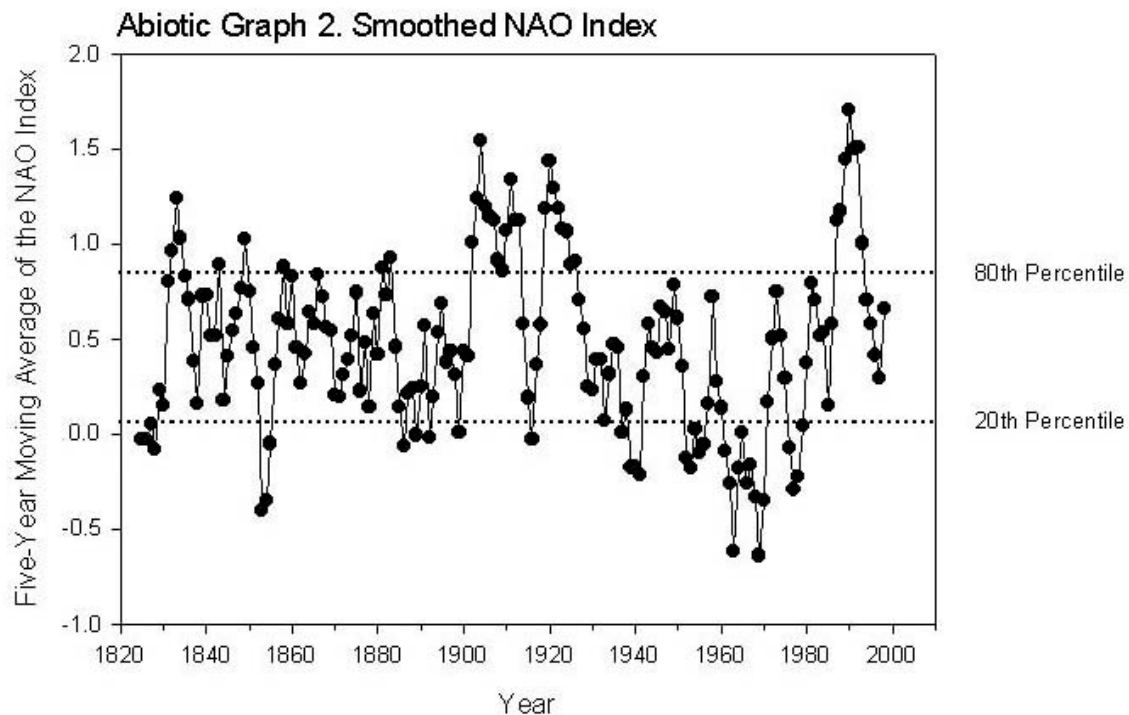
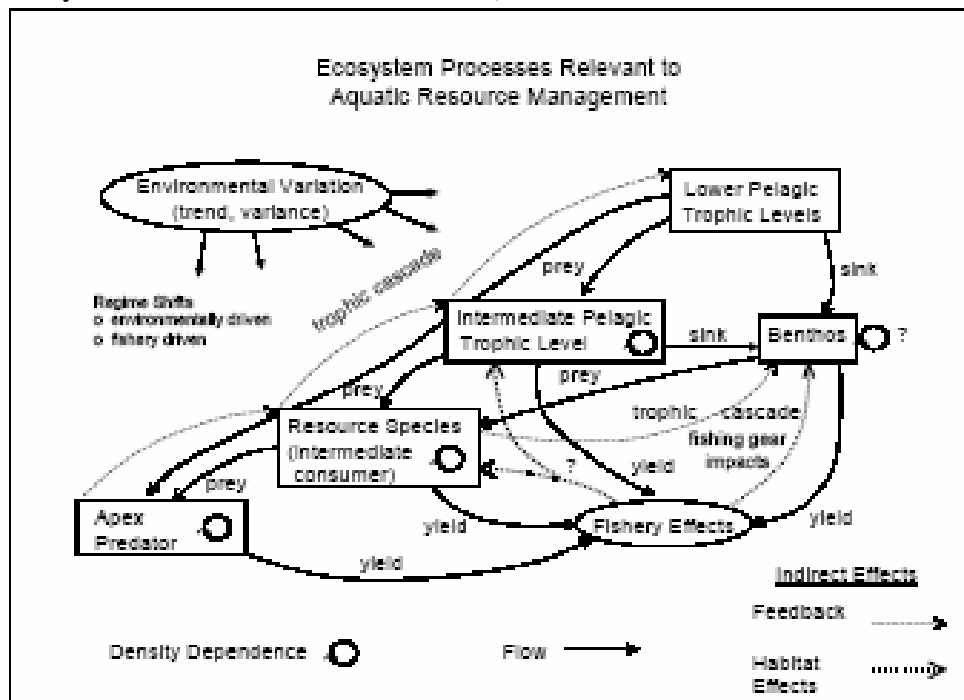


Figure 3. Complex interrelationships between abiotic and biotic processes in aquatic ecosystems (Figure courtesy of Dr. Steve Murawski, NEFSC).



In order to strengthen monitoring of biological and physical oceanographic factors, collaborative scientific partnerships with local user and industry groups should be cultivated. For example, the Fishermen's Initiative for Scientific Habitat and Ecosystem Research (FISHER Initiative) is working to establish a foundation for an ecological understanding of the marine environment in and around Stellwagen Bank and the Massachusetts Bay area. The ultimate goal of this endeavor is to coalesce fishermen's and scientist's empirical and technical knowledge into a legitimate, credible, and durable scientific foundation that promotes an ecosystem-based approach to fisheries management. Initiative partners currently include the SBNMS, Harvard University, University of New Hampshire, Massachusetts Institute of Technology's Sea Grant College Program, Boston University's Marine Program, Tufts University, the Massachusetts Division of Marine Fisheries, the Center for Coastal Studies, and numerous commercial fishermen. Fostering such collaborative partnerships will directly improve the quality of information needed for ecosystem-based management.

On May 1st 2004 Amendment 13 to the Northeast Multispecies Fishery Management Plan (<http://www.nefsc.noaa.gov/groundfish/>) went into effect. This comprehensive plan includes provisions to rebuild depleted groundfish fishery resources and to protect essential fish habitat (Figure 10 from Amendment 13). Provisions of the plan include reductions in fishing vessel allocations of days-at-sea, establishment of permanent essential fish habitat closed areas, continuation of existing rolling closures, and reductions in bycatch due to improved gear selectivity. Amendment 13 will directly increase the protection of the ecological integrity of sanctuary resources by substantially reducing fishery-related effects (Figure 3). In particular, the NEFMC omnibus essential fish habitat management plan is expected to help to preserve biodiversity and to ensure the long-term sustainability of sanctuary resources.

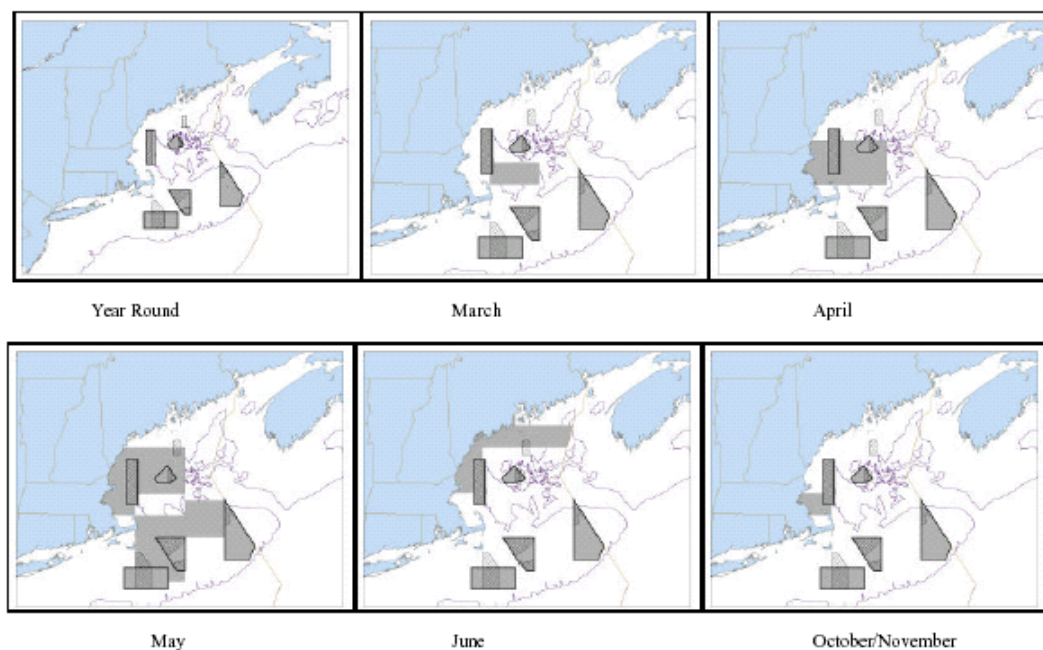


Figure 10 – Proposed action year round and seasonal closed areas. Level 3 habitat areas are cross hatched.

## **Description of the Issues**

### **Issue Statement**

#### **Goal**

The Plan C group reached consensus on the following overall goal. The overall goal was then translated into a set of distinct operational objectives along with potential management actions and performance metrics.

Recognizing (i) the sanctuary's uniqueness is substantially due to its importance as a coastal fishing ground; (ii) sanctuary bottom and water column habitats are impacted to varying degrees by human activities such as waste disposal, commercial fishing, shipping, cruise ships and cable laying in the southwestern GOM; (iii) fisheries management, conservation and habitat protection in the GOM, including the sanctuary, are the responsibility of the NEMFC, acting under the authority of the Sustainable Fisheries Act, and coastal states; and (iv) the sanctuary is not a closed system but is part of the dynamic GOM ecosystem, the goal of the Sustainable Use Action Plan is to:

1. Continue region-wide support for management, collaborative research, acquisition of fisheries-dependent information, and exploitation policies and initiatives leading to:
  - a. an understanding of and improved protection to the sanctuary's ecological integrity;
  - b. knowledge about the extent to which natural and human factors inside and outside the sanctuary affect that integrity;
  - c. an improved understanding of socioeconomic impacts of measures required to protect that integrity.
2. Maintain existing sanctuary fishing activities consistent with NEFMC management plans and their requirements for sustainable fisheries, habitat protection and bycatch reduction.
3. Strive for biological successes (e.g., increased fish abundance and diversity as well as improved habitat) while avoiding social failures (e.g., alienation of users, disruption of the historic fabric of fishing communities, loss of or inadequate sharing of socioeconomic benefits and inadequate conflict resolution).

#### **Objectives**

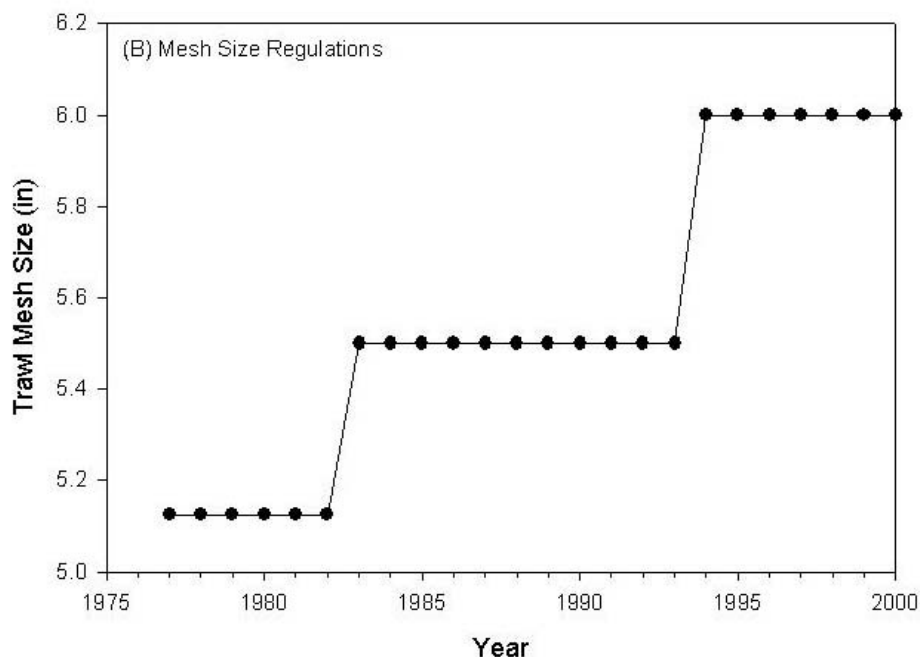
### **Addressing the Issues – Strategies for this Action Plan**

## STRATEGY EBM.1 – PROTECT ECOLOGICAL INTEGRITY

### *Strategy Summary*

#### Strategy Performance Measures:

1. Monitor yield (target yield = 16,100 mt) and fishing mortality (target  $F = 0.23$ ) on GOM cod and other stocks.
2. Monitor fraction of sanctuary's area closed to all mobile fishing gear year-round (e.g., the "sliver" of the sanctuary that lies within the western GOM habitat closed area established in Amendment 13) and monitor monthly fraction of sanctuary's area subject to rolling closures.
3. Monitor minimum trawl mesh and use at-sea observers to measure bycatch rates and discards of target and non-target species. See example below:



### *Activities (3)*

#### **(1.1)** *Maintain optimum fishery yields.*

Maintain optimum fishery yields at target fishing mortality rate through use of closed areas, trip limits, days-at-sea restrictions, and other measures. See example below:

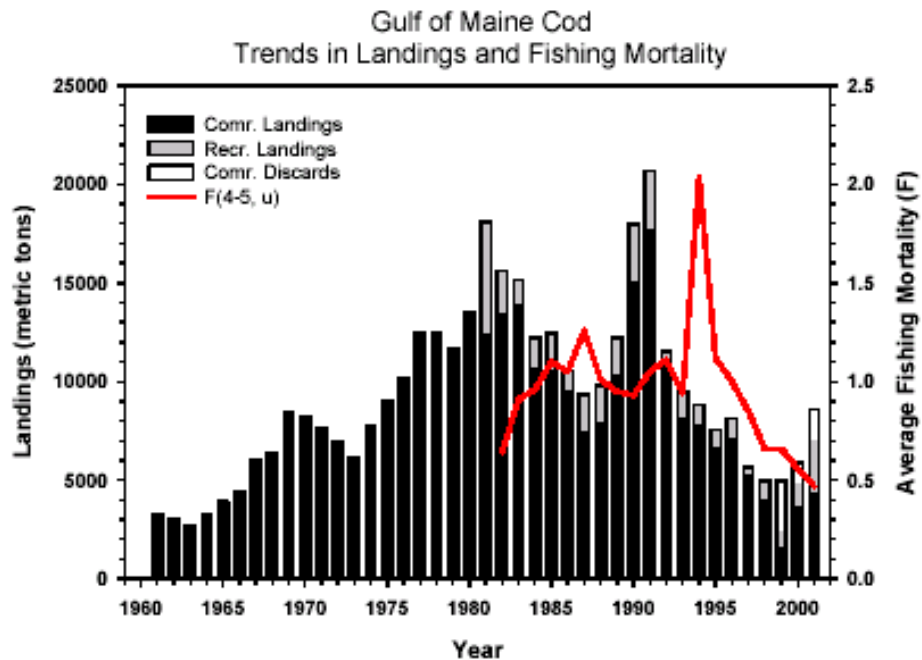


Figure F3. Trends in landings and fishing mortality for Gulf of Maine cod.

**(1.2) Protect essential fish habitat.**

Conduct FISHER Initiative project to investigate the impacts of storm and tidal events on sand lance habitat and the physical oceanography of Massachusetts Bay.

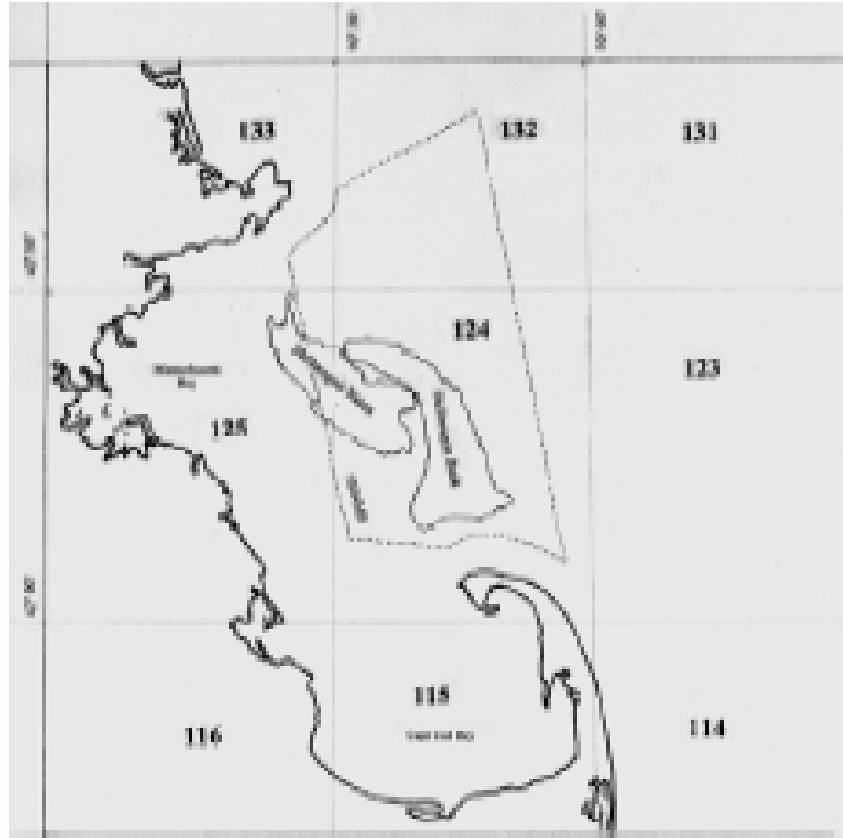
**(1.3) Reduce bycatch.**

**STRATEGY EBM.2 – IMPROVE KNOWLEDGE OF STELLWAGEN BANK’S COMMERCIAL AND RECREATIONAL FISHERIES**

***Strategy Summary***

***Strategy Performance Measure:***

1. Number of observed trips, samples per landed ton, number of interviews.
2. Time series of landings and effort in blocks 124 and 125. See example below:



### ***Activities (3)***

**(2.1)** *Increase fishery observer coverage, catch sampling at ports, and recreational interview coverage.*

**(2.2)** *Use existing VTR database to extract all available data on fishing activities by 30 minute blocks.*

**(2.3)** *Conduct FISHER Initiative project to chart anecdotal information and oral histories from local fishermen who fish on Stellwagen Bank.*

## **STRATEGY EBM.3 – UNDERSTAND ATLANTIC COD MOVEMENTS**

### ***Strategy Summary***

*Strategy Performance Measure:* Number of commercial and recreational fishermen who return cod tags, number of tags returned.

### ***Activities (1)***

**(3.1)** *Complete ongoing cooperative research program to tag Atlantic cod.*



## **STRATEGY EBM.4 – MONITOR ABUNDANCE AND DISTRIBUTION OF JUVENILE COD IN SANCTUARY AND ADJACENT WATERS**

### ***Strategy Summary***

#### ***Activities (1)***

**(4.1)** *Initiate cooperative research survey targeting juvenile cod.*

*Strategy Performance Measure:* Time series of juvenile cod abundance, spatial description of juvenile cod distribution.

## **STRATEGY EBM.5 – MONITOR ABUNDANCE AND DISTRIBUTION OF SAND EELS IN SANCTUARY AND ADJACENT WATERS**

### ***Strategy Summary***

*Strategy Performance Measure:* Time series of sand eel abundance, spatial description of sand eel distribution.

#### ***Activities (2)***

**(5.1)** *Initiate cooperative research survey targeting sand eels.*

**(5.2)** *Conduct FISHER Initiative project to examine biological processes of sand lance and associated species on Stellwagen Bank.*

## **STRATEGY EBM.6 – DEVELOP COMPREHENSIVE DESCRIPTION OF SANCTUARY BOTTOM HABITAT.**

### ***Strategy Summary***

*Strategy Performance Measure:* Spatial mapping of habitat types at high resolution.

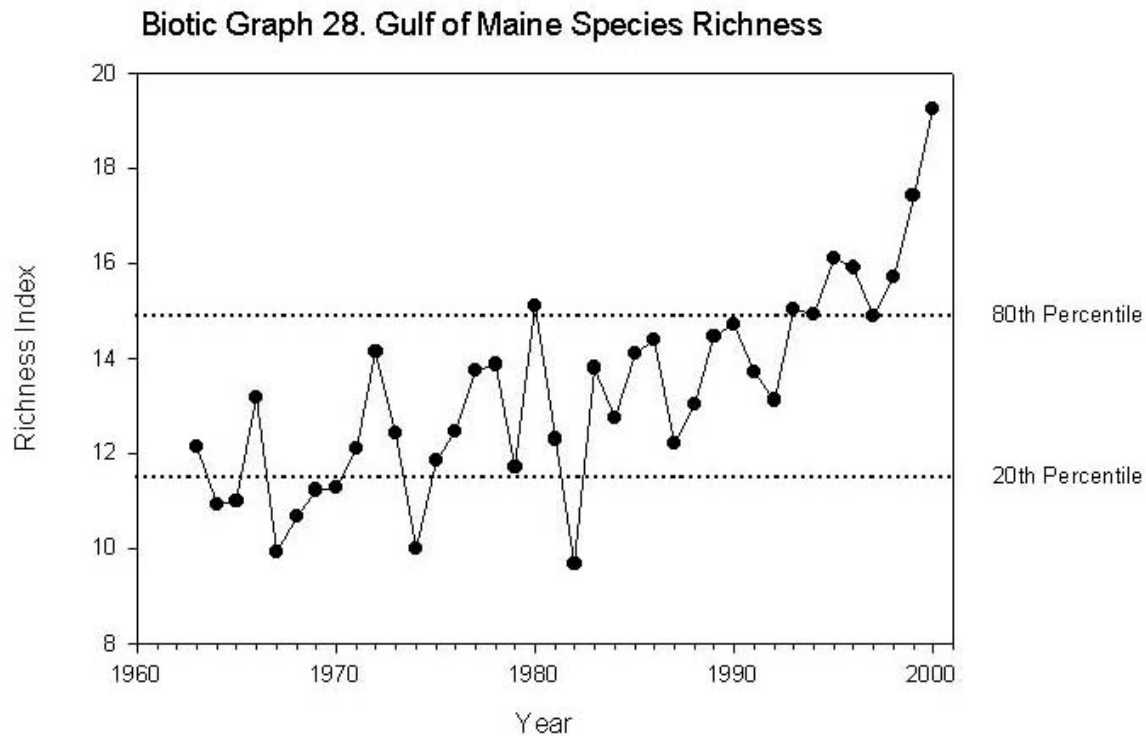
#### ***Activities (1)***

**(6.1)** *Conduct remotely operated vehicle (ROV) grab sample and video surveys or use other appropriate survey technologies to characterize habitat.*

## STRATEGY EBM.7 – DEVELOP APPROPRIATE MEASURES OF BIODIVERSITY WITHIN AND OUTSIDE THE SANCTUARY.

### *Strategy Summary*

Strategy Performance Measures: Time series of biodiversity indices. See example below:



### *Activities (1)*

**(7.1)** Continue long-term research surveys and develop appropriate analyses.

## STRATEGY EBM.8 – IMPROVE UNDERSTANDING OF THE PHYSICAL AND CHEMICAL OCEANOGRAPHY OF THE SANCTUARY AND THE GOM ECOSYSTEM.

### *Strategy Summary*

Strategy Performance Measure: Continuous online data streams for key physical parameters across the GOM.

### *Activities (2)*

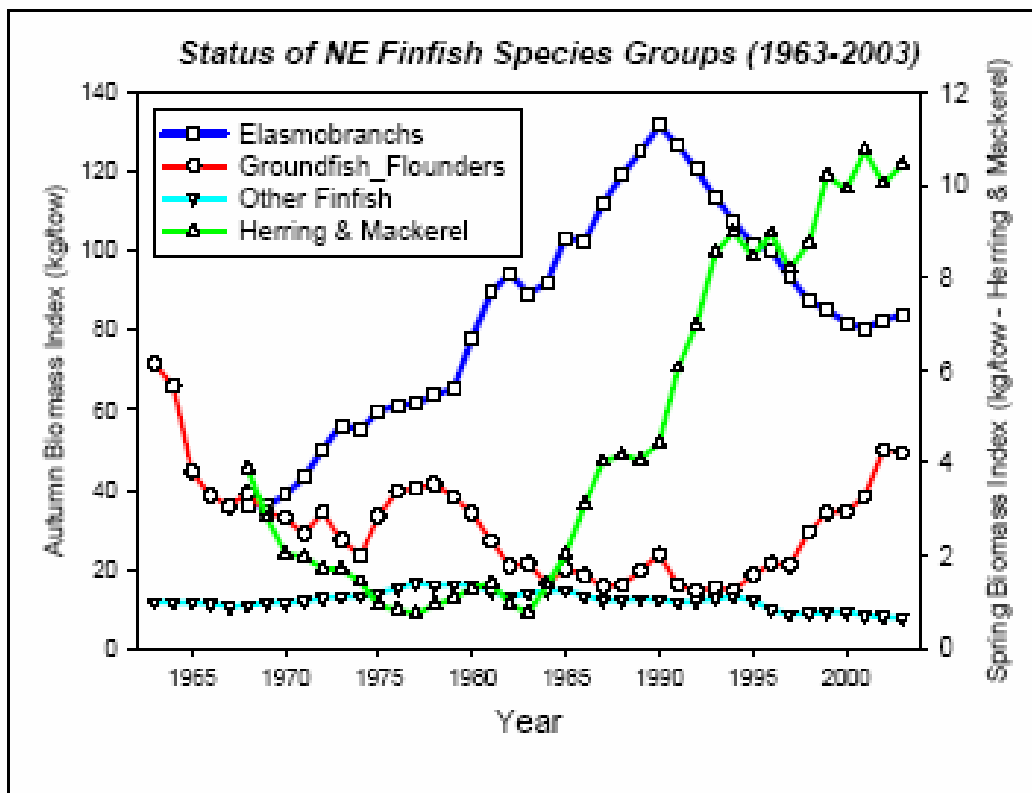
**(8.1)** Provide funding for development of GOM ocean observational systems.

**(8.2)** Conduct FISHER Initiative project to monitor zooplankton in the GOM and on Stellwagen Bank.

**STRATEGY EBM.9 - MONITOR INTERRELATIONSHIPS BETWEEN PREDATORS AND PREY IN THE SANCTUARY AND GOM ECOSYSTEM TO UNDERSTAND WHETHER THE EFFECTS OF CHANGES IN MULTISPECIES ABUNDANCE HAVE CREATED AN IMBALANCE IN THE FOOD WEB.**

***Strategy Summary***

*Strategy Performance Measure:* Time series of prey consumption estimates by important predators, such as elasmobranchs, and in particular, information on whether spiny dogfish have impacted the abundance of sand eels and other forage species such as Atlantic herring. See example below:



***Activities (1)***

**(9.1)** Continue long-term research surveys and develop appropriate analyses.